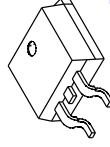


# HARRIS POWER PRODUCT LINE



TO-263AB (D<sup>2</sup>-PAK)

## RF1S Series Power MOSFET TO-263AB Product Matrix

BV <sub>DSS</sub>	I <sub>DS(ON)</sub>	0A TO 10A	11A TO 20A	21A TO 30A	31A TO 40A	41A TO 50A	51A TO 60A	61A TO 70A
30V	0.010Ω							RF1S70N03SM 30V, 70A, 0.010Ω
	0.022Ω					<b>RF1S45N03LSM</b> 30V, 45A, 0.022Ω		
	0.027Ω						RF1S60P03SM (Note) 30V, 60A, 0.027Ω	
50V	0.065Ω			RF1S30P05SM (Note) 50V, 30A, 0.065Ω				
	0.014Ω							RF1S70N06SM 60V, 70A, 0.014Ω
60V	0.022Ω					RF1S50N06SM 60V, 50A, 0.022Ω		
	0.028Ω					RF1S45N06SM 60V, 45A, 0.028Ω		
	0.047Ω			RF1S25N06SM 60V, 25A, 0.047Ω <b>RF1S30N06LES</b> 60V, 30A, 0.047Ω		<b>RF1S50N06LES</b> 60V, 50A, 0.022Ω <b>RF1S45N06LES</b> 60V, 45A, 0.028Ω		
	0.065Ω			<b>RF1S23N06LES</b> 60V, 23A, 0.065Ω RF1S30P06SM 60V, 30A, 0.065Ω				
100V	0.100Ω		<b>RF1S17N06LSM</b> 60V, 17A, 0.100Ω					
	0.140Ω		RF1S15N06SM 60V, 15A, 0.140Ω					
	0.040Ω				RF1S40N10SM 100V, 40A, 0.040Ω <b>RF1S40N10LES</b> 100V, 40A, 0.040Ω			
	0.077Ω			RF1S540SM 100V, 28A, 0.077Ω				
200V	0.080Ω			RF1S22N10SM 100V, 22A, 0.080Ω				
	0.160Ω		RF1S530SM 100V, 14A, 0.160Ω					
	0.200Ω		RF1S9540SM (Note) 100V, 19A, 0.200Ω					
	0.300Ω		RF1S9530SM (Note) 100V, 12A, 0.300Ω					
	0.18Ω		RF1S640SM 200V, 18A, 0.180Ω					
	0.400Ω		RF1S630SM 200V, 9A, 0.400Ω					
1000V	0.500Ω		RF1S9640SM (Note) 200V, 11A, 0.500Ω					
	0.800Ω		RF1S9630SM (Note) 200V, 6.5A, 0.800Ω					
	3.500Ω	RF1S4N100SM 1000V, 4.3A, 3.500Ω						

### PART NOMENCLATURE

R X XX XX X XX XXX

**DEVICE TYPE**  
F: Standard MOSFET  
L: Current Limited MOSFET

**FEATURE SUFFIX**  
L: Logic Level 5V Gate  
SM: Surface Mount Leadform (TO-263AB)  
E: ESD Protected Device  
9A: Tape and Reel

**PACKAGE DESIGNATION**  
1S: TO-262, TO-263

**VOLTAGE RATING**  
05 = 50V, 10 = 100V,  
20 = 200V, etc.

**CURRENT RATING**  
1 = 1A, 10 = 10A, 25 = 25A, etc.

**POLARITY**  
N: N-Channel  
P: P-Channel

**EXAMPLE: RF1S60P03SM**

Standard 60A, P-Channel, 30V, Surface Mount MOSFET



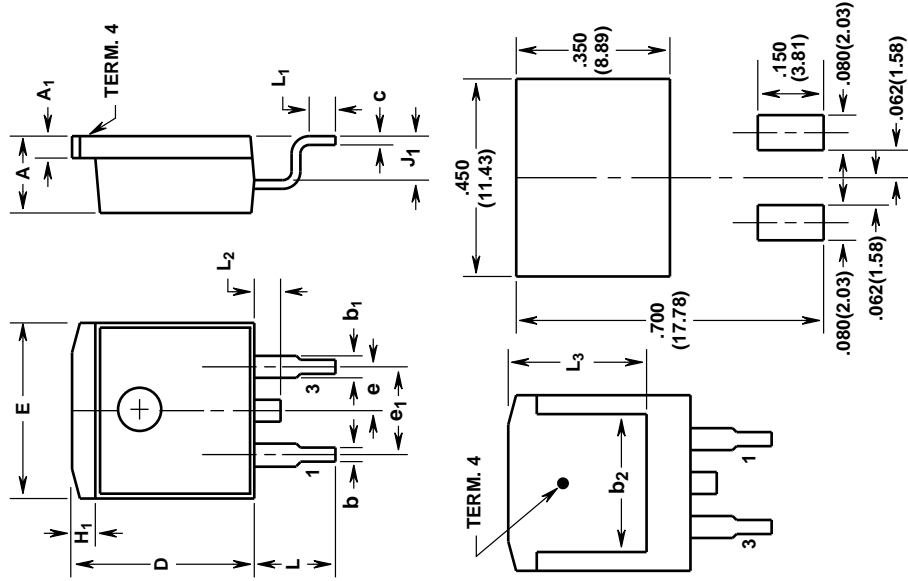
**HARRIS**  
SEMICONDUCTOR

NOTE: P-Channel Device

**BOLD = Logic Level Devices**

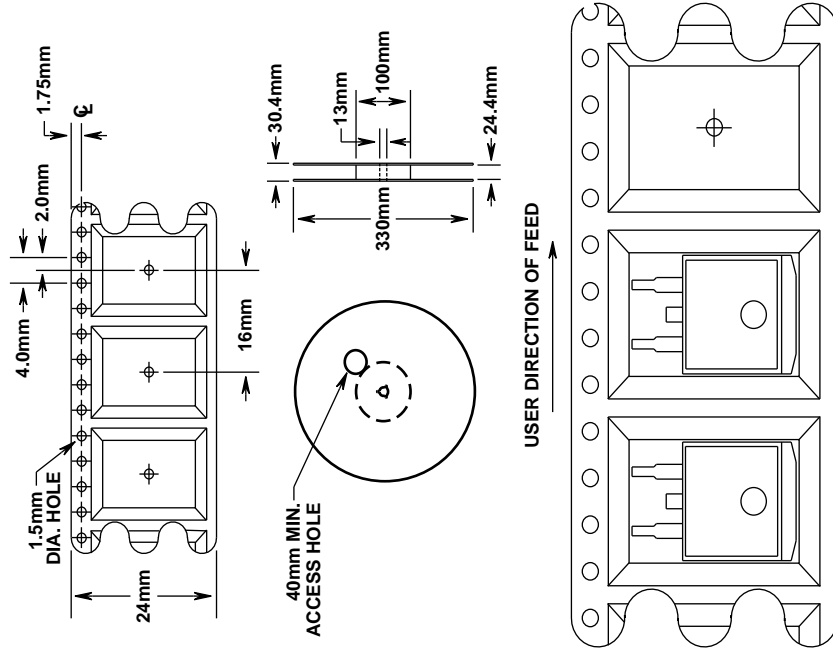
ITALICS = Future Offerings (2nd Quarter FY '97)

**TO-263AB SURFACE MOUNT JEDEC TO-263AB PLASTIC PACKAGE**



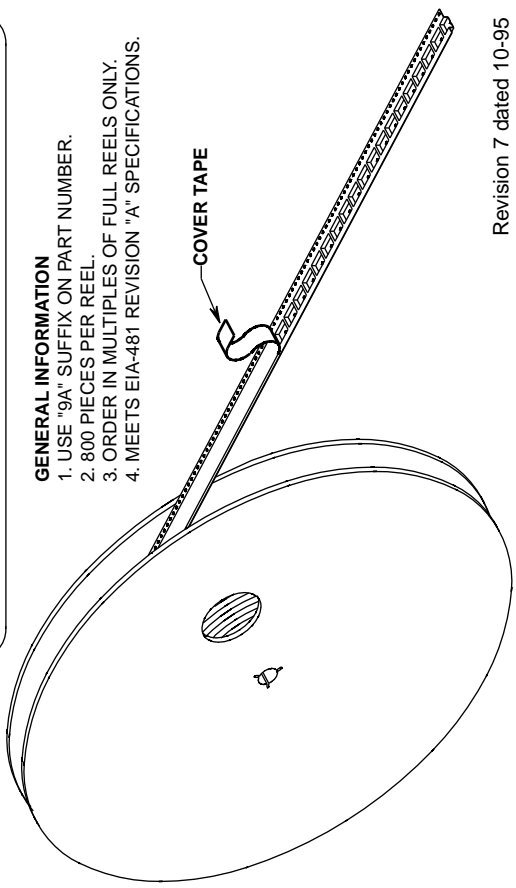
**MINIMUM PAD SIZE RECOMMENDED FOR SURFACE-MOUNTED APPLICATIONS**

**24mm TAPE AND REEL**



**GENERAL INFORMATION**

1. USE "9A" SUFFIX ON PART NUMBER.
2. 800 PIECES PER REEL.
3. ORDER IN MULTIPLES OF FULL REELS ONLY.
4. MEETS EIA-481 REVISION "A" SPECIFICATIONS.



SYMBOL	INCHES		MILLIMETERS		NOTES
	MIN	MAX	MIN	MAX	
A	0.170	0.180	4.32	4.57	-
A <sub>1</sub>	0.048	0.052	1.22	1.32	4, 5
b	0.030	0.034	0.77	0.86	4, 5
b <sub>1</sub>	0.045	0.055	1.15	1.39	4, 5
b <sub>2</sub>	0.310	-	7.88	-	2
c	0.018	0.022	0.46	0.55	4, 5
D	0.405	0.425	10.29	10.79	-
E	0.395	0.405	10.04	10.28	-
e	0.100 TYP	-	2.54 TYP	-	7
e <sub>1</sub>	0.200 BSC	-	5.08 BSC	-	7
H <sub>1</sub>	0.045	0.055	1.15	1.39	-
J <sub>1</sub>	0.095	0.105	2.42	2.66	-
L	0.175	0.195	4.45	4.95	-
L <sub>1</sub>	0.090	0.110	2.29	2.79	4, 6
L <sub>2</sub>	0.050	0.070	1.27	1.77	3
L <sub>3</sub>	0.315	-	8.01	-	2

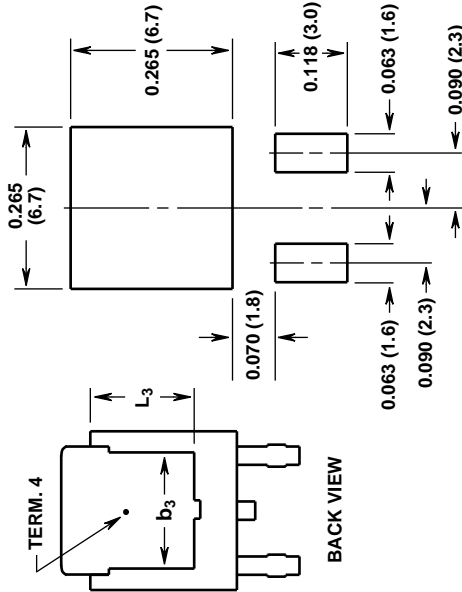
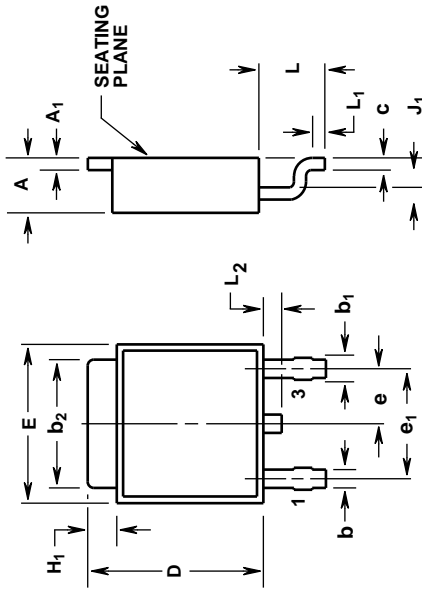
**NOTES:**

1. These dimensions are within allowable dimensions of Rev. C of JEDEC TO-263AB outline dated 2-92.
2. L<sub>3</sub> and b<sub>2</sub> dimensions established a minimum mounting surface for terminal 4.
3. Solder finish uncontrolled in this area.
4. Dimension (without solder).
5. Add typically 0.002 inches (0.05mm) for solder plating.
6. L<sub>1</sub> is the terminal length for soldering.
7. Position of lead to be measured 0.120 inches (3.05mm) from bottom of dimension D.
8. Controlling dimension: Inch.
9. Revision 7 dated 10-95.

Revision 7 dated 10-95



TO-252AA SURFACE MOUNT JEDEC TO-252AA PLASTIC PACKAGE



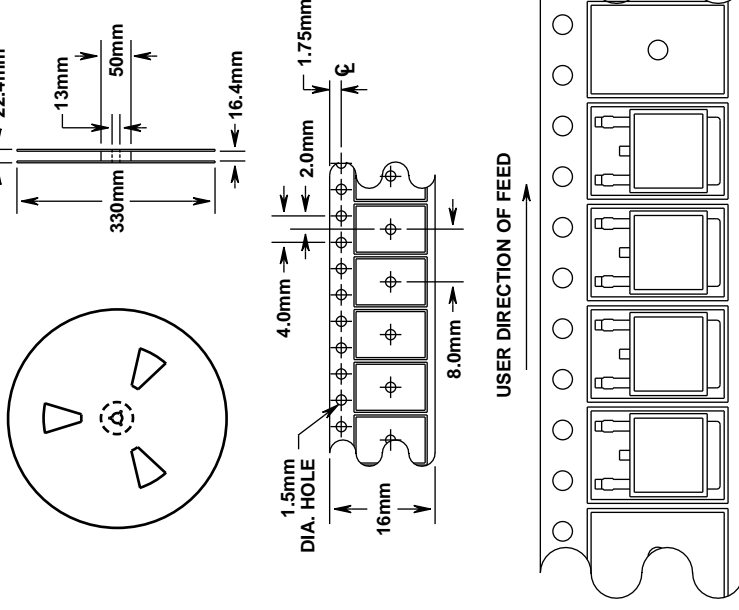
MINIMUM PAD SIZE RECOMMENDED FOR SURFACE-MOUNTED APPLICATIONS

SYMBOL	INCHES		MILLIMETERS		NOTES
	MIN	MAX	MIN	MAX	
A	0.086	0.094	2.19	2.38	-
A <sub>1</sub>	0.018	0.022	0.46	0.55	4, 5
b	0.028	0.032	0.72	0.81	4, 5
b <sub>1</sub>	0.033	0.040	0.84	1.01	4
b <sub>2</sub>	0.205	0.215	5.21	5.46	4, 5
b <sub>3</sub>	0.190	-	4.83	-	2
c	0.018	0.022	0.46	0.55	4, 5
D	0.270	0.290	6.86	7.36	-
E	0.250	0.265	6.35	6.73	-
e	0.090 TYP		2.28 TYP		7
e <sub>1</sub>	0.180 BSC		4.57 BSC		7
H <sub>1</sub>	0.035	0.045	0.89	1.14	-
J <sub>1</sub>	0.040	0.045	1.02	1.14	-
L	0.100	0.115	2.54	2.92	-
L <sub>1</sub>	0.020	-	0.51	-	4, 6
L <sub>2</sub>	0.025	0.040	0.64	1.01	3
L <sub>3</sub>	0.170	-	4.32	-	2

NOTES:

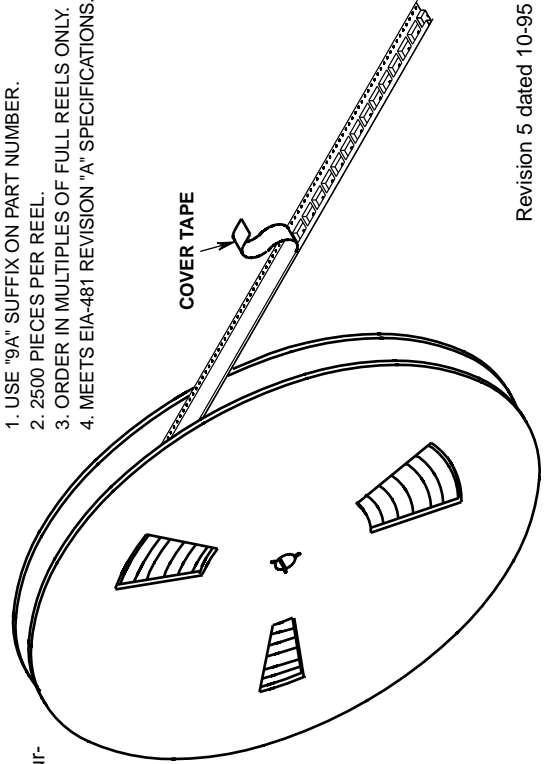
1. These dimensions are within allowable dimensions of Rev. B of JEDEC TO-252AA outline dated 9-88.
2. L<sub>3</sub> and b<sub>3</sub> dimensions establish a minimum mounting surface for terminal 4.
3. Solder finish uncontrolled in this area.
4. Dimension (without solder).
5. Add typically 0.002 inches (0.05mm) for solder plating.
6. L<sub>1</sub> is the terminal length for soldering.
7. Position of lead to be measured 0.090 inches (2.28mm) from bottom of dimension D.
8. Controlling dimension: Inch.
9. Revision 5 dated 10-95.

16mm TAPE AND REEL



GENERAL INFORMATION

1. USE "9A" SUFFIX ON PART NUMBER.
2. 2500 PIECES PER REEL.
3. ORDER IN MULTIPLES OF FULL REELS ONLY.
4. MEETS EIA-481 REVISION "A" SPECIFICATIONS.



Revision 5 dated 10-95

# HARRIS POWER PRODUCT LINE



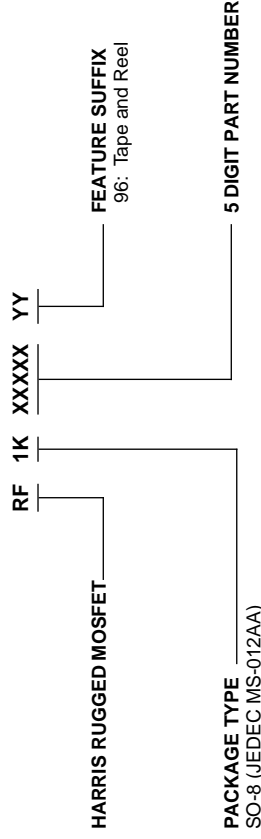
## RF1K Series Power MOSFET SO-8 Product Matrix

$BV_{DSS}$	$r_{DS(ON)}$	2A	2.5A	3.5A	6.3A	7A
12V	0.050			<b>RF1K49090</b> (Note 1) 12V, 3.5A, 0.050Ω		
	0.020					<b>RF1K49271</b> (Note 2) 12V, 7A, 0.020Ω
	0.130		<b>RF1K49092</b> (Note 1) 12V, 2.5A, 0.130Ω (P) 12V, 3.5A, 0.050Ω (N)	<b>RF1K49093</b> (Note 1) 12V, 3.5A, 0.130Ω		
30V	0.030				<b>RF1K49156</b> (Note 2) 30V, 6.3A, 0.030Ω	
	0.060			<b>RF1K49086</b> (Note 1) 30V, 3.5A, 0.060Ω	<b>RF1K49157</b> (Note 2) 30V, 6.3A, 0.030Ω	
60V	0.150	<b>RF1K49154</b> (Note 1) 60V, 2A, 0.150Ω				

### NOTES:

- Dual Function MOSFET,
- Single Function MOSFET

### PART NOMENCLATURE



### EXAMPLE: RF1K49092

Avalanche Rated, N-Channel, Logic Level,  
Complementary Enhancement Mode MOSFET  
12V, 3.5A, 0.050Ω  $r_{DS(ON)}$

### Features

- Low voltage inputs eliminate the need for charge pumps in high side load switching applications
- Low  $r_{DS(ON)}$  reduces power consumption and increases efficiency
- Low profile package, excellent for height restricted applications
- Dual functions per package increase board packing density and reduces part count
- Surface mount, small footprint, aids high volume assembly
- Designed, tested, and rated for ruggedness
- Low voltage logic level input characteristics
- The most comprehensive data sheet characterization of any supplier
  - Temperature compensated SPICE models
  - Single pulse UIS curves
  - Switching vs gate resistance
  - $r_{DS(ON)}$  vs  $V_{GS}$  curves

### Applications

### Telecom/Communications

- DC/DC converters
- Synchronous buck regulator circuits
- Ultra efficient synchronous boost regulators for 5V-20V systems
- Cellular telephones/Wireless products
- Battery charging circuits
- Power management circuits

### Computer/EDP

- Load management and power control
- Laptop computer PCMCIA cards, Fax/Modems and display back lighting
- 5V and 3.3V low power applications
- Low voltage DC/DC converters
- Motor Control
  - Tape drives, disk drives, and low voltage motors



**HARRIS**  
SEMICONDUCTOR

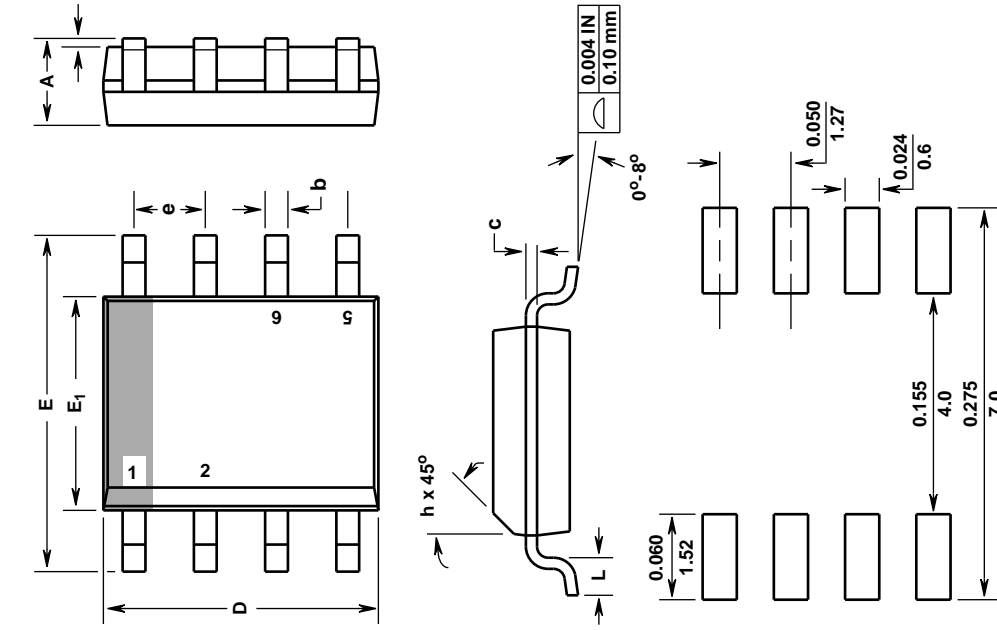
BOLD = Logic Level Devices

ITALICS = Future Offerings (2nd Quarter FY '97)

LC96586\_3.1

MS-012AA 8 LEAD JEDEC MS-012AA SMALL OUTLINE PLASTIC PACKAGE

12mm TAPE AND REEL

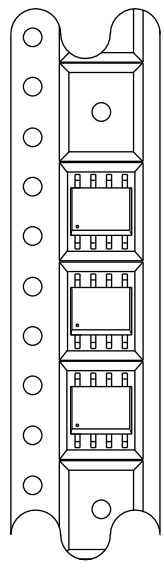
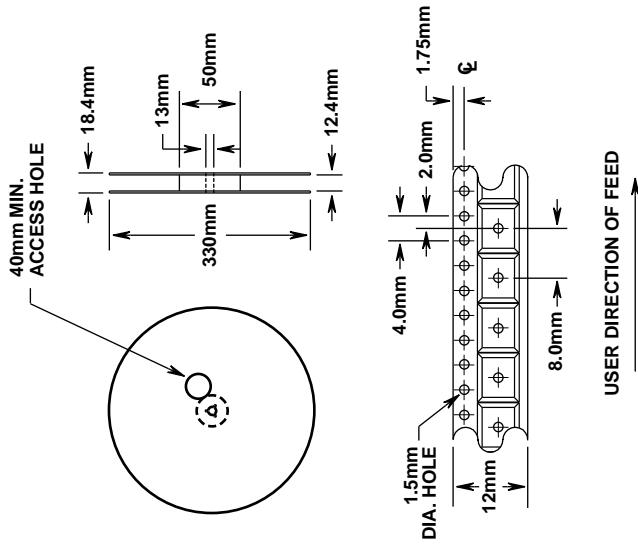


MINIMUM RECOMMENDED FOOTPRINT FOR SURFACE-MOUNTED APPLICATIONS

SYMBOL	INCHES		MILLIMETERS		NOTES
	MIN	MAX	MIN	MAX	
A	0.0532	0.0688	1.35	1.75	-
A <sub>1</sub>	0.004	0.0098	0.10	0.25	-
b	0.013	0.020	0.33	0.51	-
c	0.0075	0.0098	0.19	0.25	-
D	0.189	0.1968	4.80	5.00	2
E	0.2284	0.244	5.80	6.20	-
E <sub>1</sub>	0.1497	0.1574	3.80	4.00	3
e	0.050 BSC		1.27 BSC		-
H	0.0099	0.0196	0.25	0.50	-
L	0.016	0.050	0.40	1.27	4

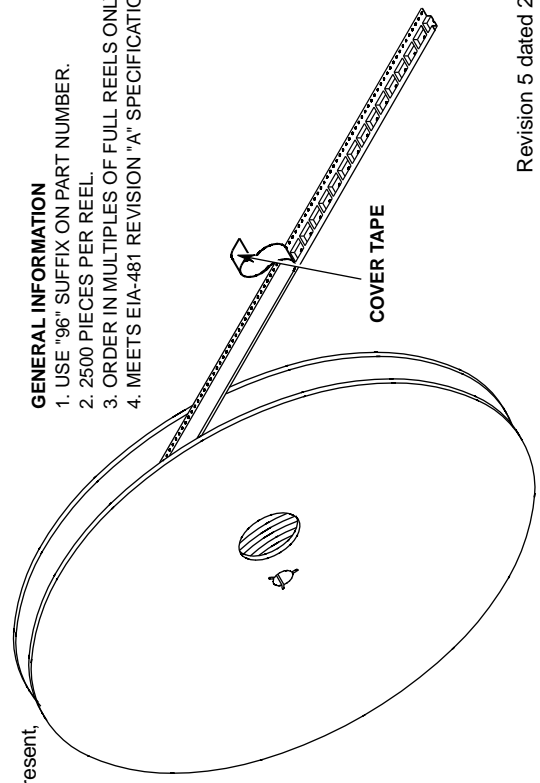
NOTES:

- All dimensions are within allowable dimensions of Rev. C of JEDEC MS-012AA outline dated 5-90.
- Dimension "D" does not include mold flash, protrusions or gate burrs. Mold flash, protrusions or gate burrs shall not exceed 0.006 inches (0.15mm) per side.
- Dimension "E<sub>1</sub>" does not include inter-lead flash or protrusions. Inter-lead flash and protrusions shall not exceed 0.010 inches (0.25mm) per side.
- "L" is the length of terminal for soldering.
- The chamfer on the body is optional. If it is not present, a visual index feature must be located within the crosshatched area.
- Controlling dimension: Millimeter.
- Revision 5 dated 2-23-96.



GENERAL INFORMATION

- USE "96" SUFFIX ON PART NUMBER.
- 2500 PIECES PER REEL.
- ORDER IN MULTIPLES OF FULL REELS ONLY.
- MEETS EIA-481 REVISION "A" SPECIFICATIONS.



Revision 5 dated 2-96

# HARRIS DISCRETE POWER PRODUCT LINE

TO-251/252 10V GATES STANDARD DEVICE

V <sub>DS</sub> (V)	r <sub>(dson)</sub>	I (A)	TO-251AA	TO-252AA	CHANNEL
50V	0.047Ω	16A	RFD16N05	RFD16N05SM	N
	0.100Ω	14A	RFD14N05	RFD14N05SM	N
	0.150Ω	15A	RFD15P05	RFD15P05SM	P
50V	0.300Ω	8A	RFD8P05	RFD8P05SM	P
	0.047Ω	16A	RFD16N06	RFD16N06SM	N
60V	0.100Ω	14A	RFD14N06	RFD14N06SM	N
	0.150Ω	15A	RFD15P06	RFD15P06SM	P
	0.300Ω	8A	RFD8P06E	RFD8P06ESM	P
	0.150Ω	12A	RFD3055	RFD3055SM	N
	0.270Ω	8.4A	IRFU121	IRFR121	N
100V	0.270Ω	8.4A	IRFU120	IRFR120	N
	0.540Ω	4.7A	IRFU110	IRFR110	N
	0.600Ω	5.6A	IRFU9120	IRFR9120	P
	1.200Ω	3.1A	IRFU9110	IRFR9110	P
150V	0.800Ω	4.6A	IRFU221	IRFR221	N
	0.800Ω	4.6A	IRFU220	IRFR220	N
200V	1.200Ω	3.8A	IRFU222	IRFR222	N
	1.500Ω	0.6A	IRFU9220	IRFR9220	P
250V	2.000Ω	2.2A	IRFU214	IRFR214	N
	1.800Ω	3.1A	IRFU321	IRFR321	N
350V	1.800Ω	3.1A	IRFU320	IRFR320	N
	2.500Ω	2.6A	IRFU322	IRFR322	N
450V	3.000Ω	2.5A	IRFU421	IRFR421	N
	3.000Ω	2.5A	IRFU420	IRFR420	N
500V	4.000Ω	2.2A	IRFR422	IRFR422	N
	7.000Ω	1.5A	IRFU410	IRFR410	N

TO-251/252 LOGIC LEVEL DEVICES

V <sub>DS</sub> (V)	r <sub>(dson)</sub>	I (A)	TO-251AA	TO-252AA	CHANNEL
30V	0.022Ω	16A	RFD16N03L	RFD16N03LSM	N
	0.200Ω	10A	RFD10P03L	RFD10P03LSM	P
	0.047Ω	16A	RFD16N05L	RFD16N05LSM	N
50V	0.100Ω	14A	RFD14N05L	RFD14N05LSM	N
	0.047Ω	16A	RFD16N06LE	RFD16N06LES	N
60V	0.065Ω	15A	RFD15N06LE	RFD15N06LES	N
	0.100Ω	14A	RFD14N06L	RFD14N06LSM	N
	0.135Ω	12A	RFD12N06RLE	RFD12N06RLES	N
	0.150Ω	12A	RFD3055LE	RFD3055LES	N
	0.600Ω	4A	RFD4N06L	RFD4N06LSM	N
80V	0.800Ω	3A	RFD3N08L	RFD3N08LSM	N
	0.300Ω	7A	RFD7N10LE	RFD7N10LES	N

TO-262/263 10V GATES STANDARD DEVICE

V <sub>DS</sub> (V)	r <sub>(dson)</sub>	I (A)	TO-262AA	TO-263AB	CHANNEL
30V	0.010Ω	70A	RF1S70N03	RF1S70N03SM	N
	0.027Ω	60A	RF1S60P03	RF1S60P03SM	P
	0.065Ω	30A	RF1S30P05	RF1S30P05SM	P
50V	0.014Ω	70A	RF1S70N06	RF1S70N06SM	N
	0.022Ω	50A	RF1S50N06	RF1S50N06SM	N
	0.028Ω	45A	RF1S45N06	RF1S45N06SM	N
	0.047Ω	25A	RF1S25N06	RF1S25N06SM	N
	0.075Ω	30A	RF1S30P06	RF1S30P06SM	P
100V	0.140Ω	15A	RF1S15N06	RF1S15N06SM	N
	0.080Ω	22A	RF1S22N70	RF1S22N70SM	N
	0.160Ω	14A	RF1S530	RF1S530SM	N
	0.200Ω	19A	RF1S9540	RF1S9540SM	P
	0.300Ω	12A	RF1S9530	RF1S9530SM	P
200V	0.040Ω	40A	RF1S40N10	RF1S40N10SM	N
	0.077Ω	28A	RF1S540	RF1S540SM	N
	0.180Ω	18A	RF1S640	RF1S640SM	N
	0.400Ω	9A	RF1S630	RF1S630SM	N
	0.500Ω	11A	RF1S9640	RF1S9640SM	P
1000V	0.800Ω	6.5A	RF1S9630	RF1S9630SM	P
	3.500Ω	4.3A	RF1S4N700	RF1S4N700SM	N

TO-262/263 LOGIC LEVEL DEVICES

V <sub>DS</sub> (V)	r <sub>(dson)</sub>	I (A)	TO-262AA	TO-263AB	CHANNEL
30V	0.022Ω	45A	RF1S45N03L	RF1S45N03LSM	N
	0.22Ω	50A	RF1S50N06LE	RF1S50N06LES	N
	0.028Ω	45A	RF1S45N06LE	RF1S45N06LES	N
60V	0.047Ω	30A	RF1S30N06LE	RF1S30N06LES	N
	0.065Ω	23A	RF1S23N06LE	RF1S23N06LES	N
	0.100Ω	17A	RF1S17N06L	RF1S17N06LSM	N

SO-8 10V GATES STANDARD DEVICE LITTLE FET DEVICES

V <sub>DS</sub> (V)	r <sub>(dson)</sub>	I (A)	DEVICE	PACKAGE	CHANNEL
30V	0.030Ω	6.3A	RF1K49157	SO-8	N
	0.060Ω	3.5A	RF1K49086	SO-8	N

SO-8 LOGIC LEVEL DEVICES LITTLE FET DEVICES

V <sub>DS</sub> (V)	r <sub>(dson)</sub>	I (A)	DEVICE	PACKAGE	CHANNEL
12V	0.020Ω	7A	RF1K49211	SO-8	N
	0.050Ω	3.5A	RF1K49092	SO-8	N
	0.130Ω	2.5A	RF1K49090	SO-8	N
RF1K49092			SO-8	P	
30V	0.030Ω	6.3A	RF1K49156	SO-8	N
	0.060Ω	3.5A	RF1K49088	SO-8	N
	0.150Ω	2.0A	RF1K49154	SO-8	N

Parts can be shipped in tape and reel form by placing 9A at the end of the part number.  
EXAMPLE: RFD16N03L-SM9A - Same as RFD16N05LSM but Tape & Reeled.

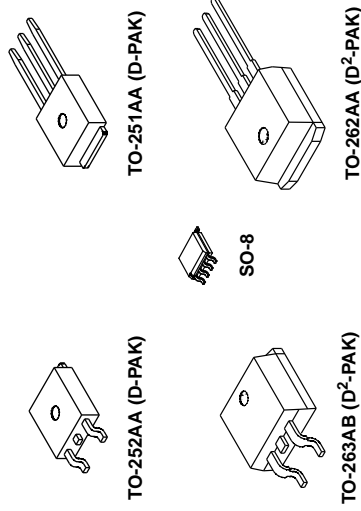
ITALICS = Future Offerings (2nd Quarter FY '97)

# HARRIS DISCRETE POWER PRODUCT LINE - Plastic Packages

## P-CHANNEL DEVICES

V <sub>DSS</sub> (V)	r <sub>(DSON)</sub>	I (A)	DEVICE	PACKAGE	CHANNEL
12V	0.050Ω	2.5A	RF1K49092	SO-8	P
	0.130Ω	3.5A	RF1K49093	SO-8	P
30V	0.027Ω	60A	RF1S60P03/SM	TO-262AA/263AB	P
	0.065Ω	30A	RF1S30P05SM	TO-262AA/263AB	P
	0.200Ω	10A	RFD10P03L/SM	TO-251AA/252AA	P
	0.300Ω	8A	RFD8P05/SM	TO-251AA/252AA	P
50V	0.150Ω	15A	RFD15P05/SM	TO-251AA/252AA	P
	0.075Ω	30A	RF1S30P06/SM	TO-262AA/263AB	P
60V	0.150Ω	15A	RFD15P06/SM	TO-251AA/252AA	P
	0.300Ω	8A	RFD8P06E/SM	TO-251AA/252AA	P
	0.200Ω	19A	RF1S9540/SM	TO-262AA/263AB	P
	0.300Ω	12A	RF1S9530/SM	TO-262AA/263AB	P
100V	0.600Ω	5.6A	IRFR9120	TO-252AA	P
	1.200Ω	3.1A	IRFU9120	TO-251AA	P
			IRFR9110	TO-252AA	P
			IRFU9110	TO-251AA	P
200V	0.500Ω	11A	RF1S9640/SM	TO-262AA/263AB	P
	0.800Ω	6.5A	RF1S9630/SM	TO-262AA/263AB	P
	1.500Ω	0.6A	IRFR9220	TO-252AA	P
			IRFU9220	TO-251AA	P

## PLASTIC PACKAGES



## Advanced Power MOS

### Features

- Current limiting, voltage clamping
- Over voltage gate protection
- Thermal protection
- Logic level

### Applications

- Fault tolerant motor drives
- Stall protection
- Current inrush limiting
- Automotive headlamp drivers
- Diagnostic motor controls

## Logic Level MOSFETs

### Features

- Full drain current rating with 5V gate drive
- Microprocessor and logic compatible
- Electrostatic discharge protected gates available
- Avalanche energy capability available
- Both N and P channel devices
- BV<sub>DSS</sub> rating of 50V to 200V
- Surface mount TO-251/2 (D-PAK), MS-012 (SO-8), TO-262/3 (D<sup>2</sup>-PAK)

### Applications

- Solid state DC relays
- Lamp drivers
- Stepper motor drives
- Small motor controls
- High side drivers
- SMPS MOSFET predrivers

## JEDEC MOSFETs

### Features

- JEDEC Registered MOSFETs for Military and High Rel Applications
- BV<sub>DSS</sub> 60V to 500V
- N and P channel devices
- Hermetic packages

### Applications

- Military
- High Reliability
- Space

## Standard RFX and IRFX MOSFETs N and P Channel

### Features

- Size 1 through 5 die
- All IRF types are avalanche capable
- BV<sub>DSS</sub> up to 1000V

### Applications

- Offline and DC/DC converters
- Power supplies
- Pulse generators
- Super efficient DC/DC converters
- Solid state DC relays
- Low loss DC switches
- Lamp drivers
- Operational amplifier buffer stage
- Stepper motor drives
- Small motor controls
- Laser diode pulse generators
- SMPS drivers